

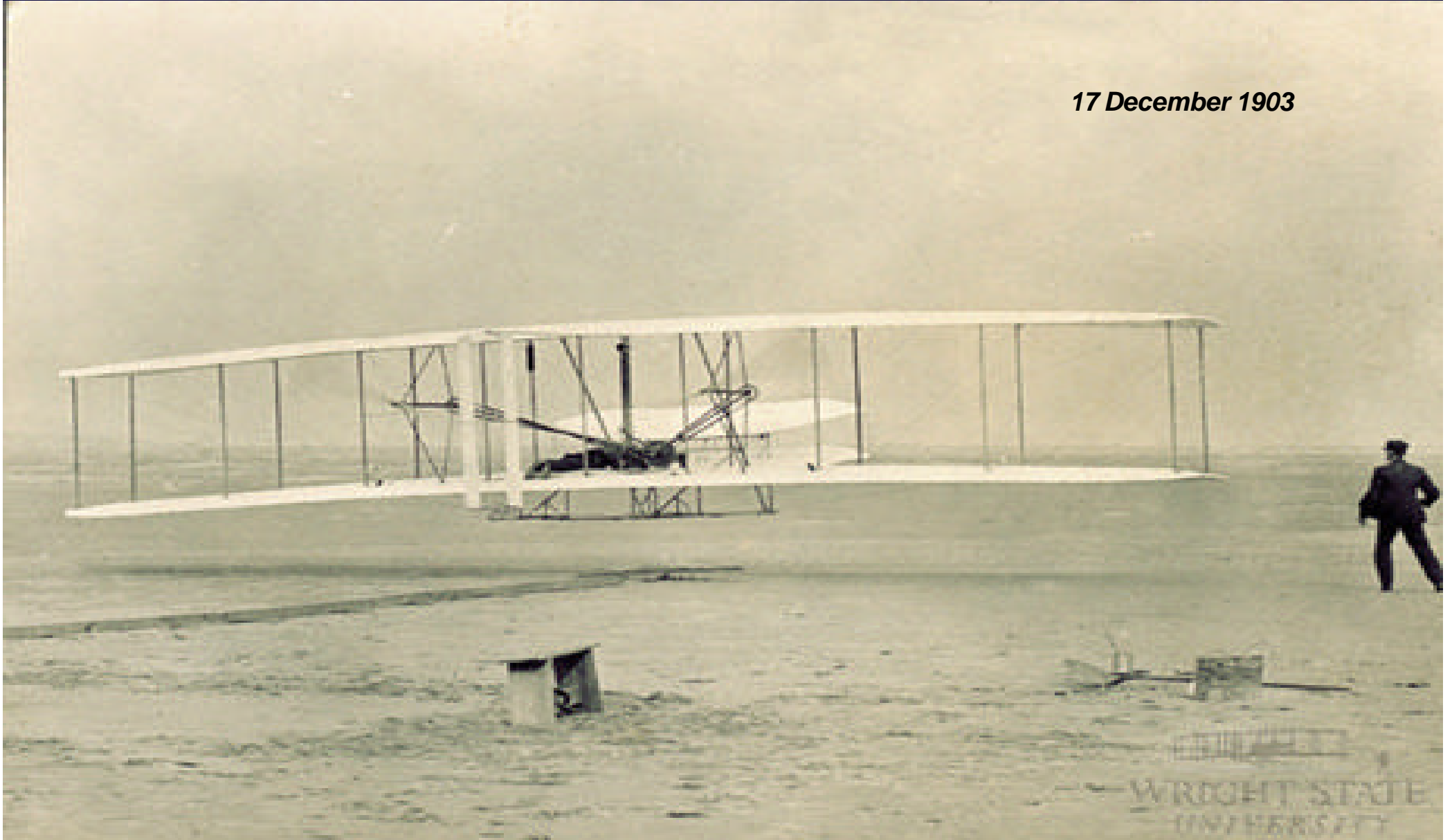
Mitigating Maintenance Errors in Aviation

*Royal Aeronautical Society, London,
15 October 2003*

David Hall

100 Years of Powered Flight

17 December 1903



100 Years of Powered Flight

- 100 years of aviation maintenance



Charles Taylor

100 Years of Powered Flight

- 100 years of aviation maintenance
- 100 years of maintenance and inspection errors



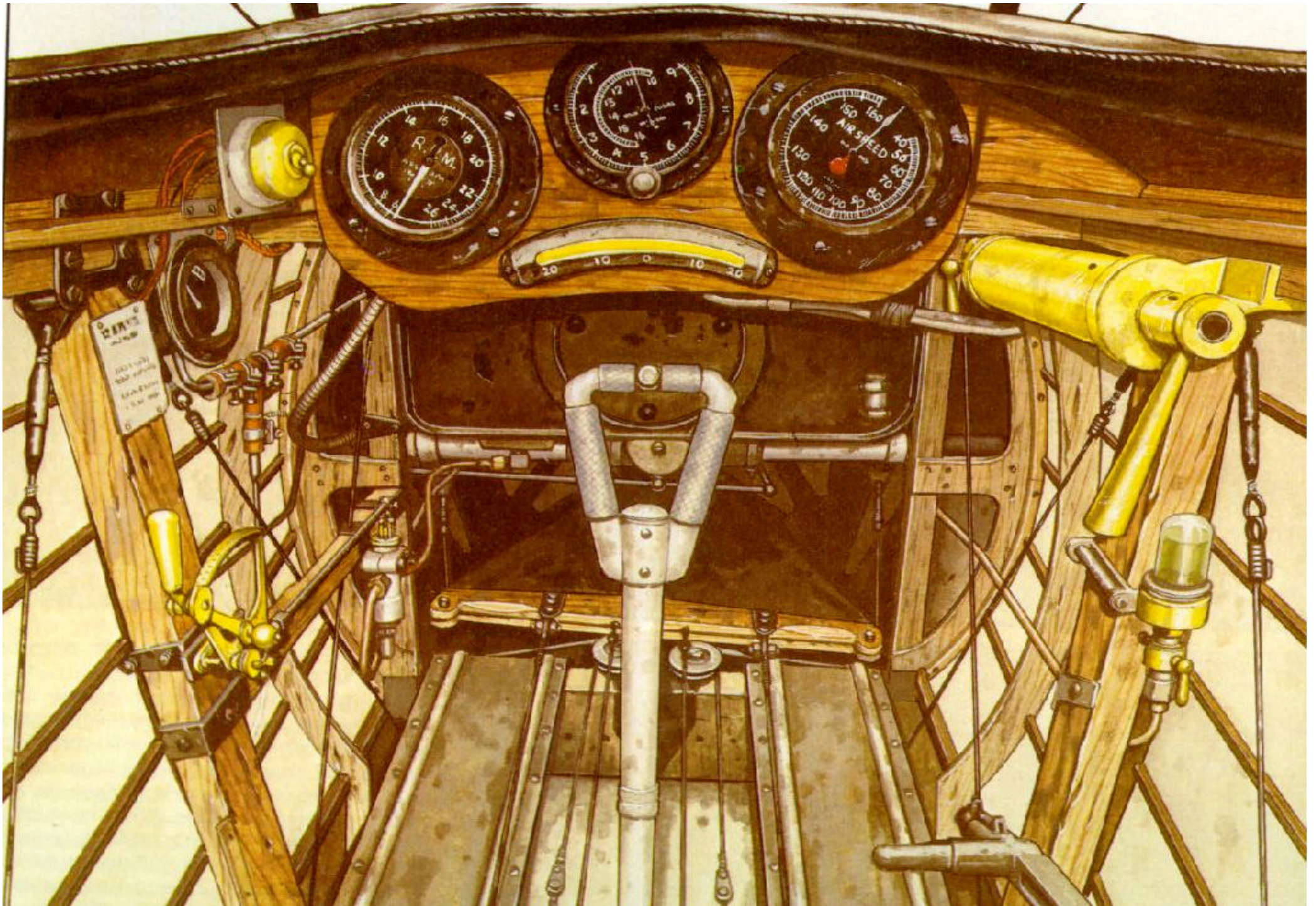
Charles Taylor



Thomas Selfridge, first airplane fatality, 17 Sept 1908

Safety Assurance in Aviation Maintenance

- The first Aircraft Maintenance Engineer's licence issued by the Air Ministry was to Mr W Kelly in April 1919
 - Convention relating to the regulation of aerial navigation, Paris, October 13, 1919
 - Maintenance approvals granted after WWII
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- Safety assurance started to shift from competence of the individual to an organisational responsibility – A system of safety







High Reliability Theory

- Accidents can be prevented by good organisational / system design and management
- Safety is the organisation's number one objective
- Redundancy enhances safety through duplication and overlap
- Procedures define the boundaries of safety
- Continuous training can maintain reliable operations
- Learning from accidents and incidents can be effective

Managing Error is Not New

- Licensing of Engineers
- Training and competence assessment
- Audits
- Work Cards
- Tags and Flags
- Warning notes in manuals
- Procedures
- Discipline
- TQM, Six Sigma
- Second Inspections

Who has been traditionally managing the errors?

- The Regulator?
- Quality Assurance?
- Aircraft Designers?
- Trainers?
- Maintenance Manual and Procedure writers?
- Line Supervisors?
- Maintenance Managers?
- Human Resources?

What was Wrong with the 'Traditional' Approach to Managing Errors?

- Collectively they have not prevented a rise in maintenance errors
- They are piecemeal attempts at fixing problems
- They are reactive
- No data is collected to determine the systemic problems
- Ownership of the problems is fragmented
- Focuses on active failures and not the latent and system failures

A Different Approach to Error

- Errors will naturally occur in any system
- Errors, violations and at-risk behaviour need to be separated from their effects
- The underlying causes of errors, violations and at-risk behaviour must be identified
- Managing the causes of error, not the error itself will provide a better return on investment (manage the manageable)

A Different Approach to Error

- 70% of errors have their causes rooted in system deficiencies, for which management have responsibility, not the front-line technician
- Data collection is vital in determining the types of errors that recur and help understand their causes
- Punishment of an erring individual is reserved for reckless behaviour

History of Error Management in the UK

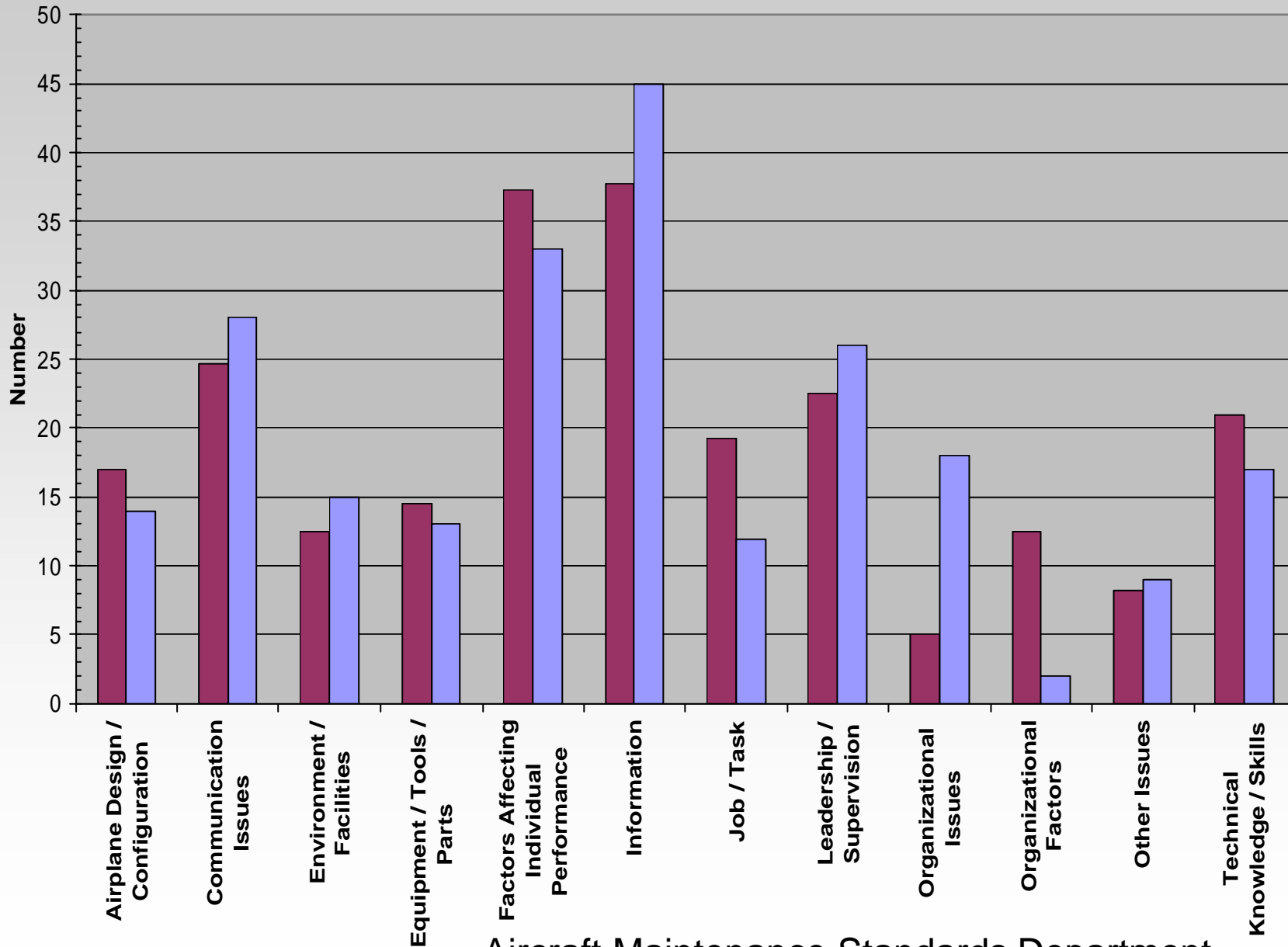
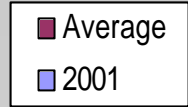
- 1992 - Boeing MEDA group (British Airways)
- 1996 - CAA promotion of error management principles
- 2000 - CAA policy stated in airworthiness AWN71
- 2000 - JAR-145 NPA 12 proposals included error management
- 2004 - JAR-145 Amendment 5 requires occurrence management systems

New Definition of Maintenance Error

- *“A maintenance error is considered to have occurred when the maintenance system, which includes the human element, fails to perform in the manner expected in order to achieve its safety objectives.”*

Source: UK CAA AWN 71, March 2000

Factors Average last 4 Years + Total for 2001



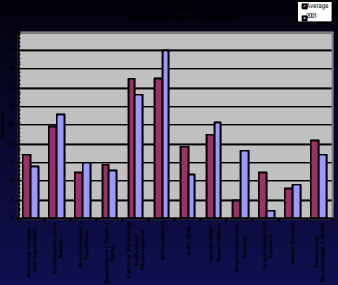
Aircraft Maintenance Standards Department



Where we are today

- ✓ The current methodology works well in addressing 'normal errors' (the honest mistake)
- ✗ Errors are investigated to fix the immediate problem, not the prevention of future events
- ✗ Error investigators are reluctant to pursue the organisational factors

Where we are today



- ✘ Procedural violations and at-risk behaviour are significant contributing factors but are not adequately captured to enable analysis
- ✘ The causes of violations and at-risk behaviour are not investigated
- ✘ Discipline is determined by the severity of the outcome, not the behaviour of the person

Where we need to go

- Optimise on the Occurrence Management System now required by JAR-145
- Human Hazard Analysis
- Verification and validation of maintenance data
- Obtain a better understanding of the maintenance system
- Obtain a better understanding of how people normally behave within the maintenance system
- LOSA for maintenance??

“Risk will never be eliminated from high-risk systems.... However, we might stop blaming the wrong people and the wrong factors, and stop trying to fix the systems in ways that only make them riskier”

Charles Perrow

Aircraft Maintenance Standards Department

